

THE BIG RIP

The **Big Rip** is a hypothetical model concerning the ultimate fate of the universe, in which the matter of the universe, from stars and galaxies to atoms and subatomic particles, and even space-time itself, is progressively torn apart by the expansion of the universe at a certain time in the future.

According to the hypothesis, the sheer size of the universe will become infinite in the future and gravity will no longer be able to hold particles together.

First, gravity would be too weak to hold the Milky Way and other individual galaxies together. Then, the Solar System (or systems similar to our own at this time) would be gravitationally torn apart. In the last minutes, stars and planets would be torn apart, and an instant before the end, atoms would be destroyed. At the end of the universe, space-time itself will be ripped apart.

THE BIG CRUNCH AND BIG BOUNCE

The **Big Crunch** is one possible scenario for the ultimate fate of the universe, in which the expansion of space eventually reverses and the universe collapses, ultimately ending as a black hole or causing a reformation of the universe starting with another Big Bang.

For a contracting Universe it is expected that superclusters of galaxies would merge among themselves followed by galaxy clusters and later individual galaxies. By the time stars were so close together that collisions among them were frequent, the temperature of the Universe would have increased so much that stars would explode, leaving behind a hot gas, whose atoms would break down. All this material would then be absorbed by the already forming black holes before the Big Crunch itself. The Big Bounce idea goes that a new Big Bang will take place and the universe will be born again, over and over.

THE BIG FREEZE

The **Big Freeze** is the theory that the expansion of the universe will continue forever. As the universe continues to expand, it will cool, eventually becoming too cold to sustain life.

It is believed that the space between clusters of galaxies will grow at an increasing rate. Stars are expected to form normally for 1-100 trillion years, but eventually the supply of gas needed for star formation will be exhausted. And as existing stars run out of fuel and cease to shine, the universe will slowly grow darker, one star at a time. Eventually, all heat in the universe will cease to exist, all light will cease to exist and the Universe will be "dead" expanding into darkness forever.